Barkan Wireless IP Holdings, L.P.
v.
T-Mobile US, Inc.

Barkan's Technology Tutorial
Case No. 2:21-cv-00034-JRG

This presentation is accompanied by a voice-over.

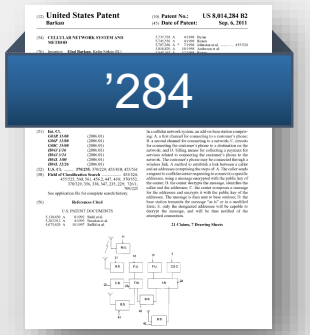
If you cannot hear the narrator's voice at this time, please adjust your computer's audio settings.

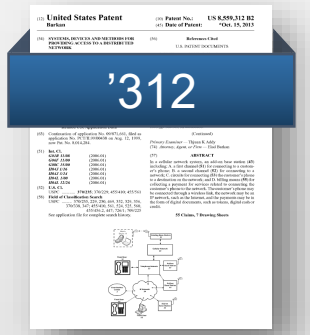
Dr. Elad Barkan

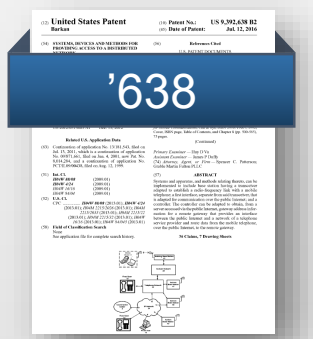
- Barkan Wireless
- Bachelor's and PhD in Computer Engineering from Israel's premiere technical university
- Inventor of many inventions in the cellular and encryptions space
- Executive and co-founder of mobile telecommunications start-ups
- Internationally renowned for breaking GSM's cellular encryption protocol

TECHNION
Israel Institute of Technology

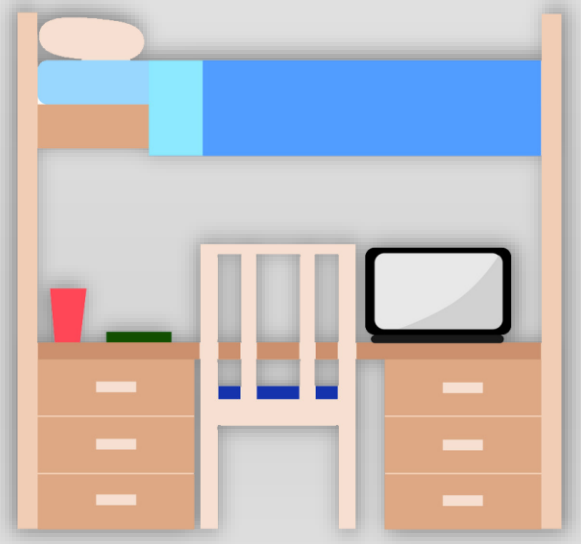
The Invention







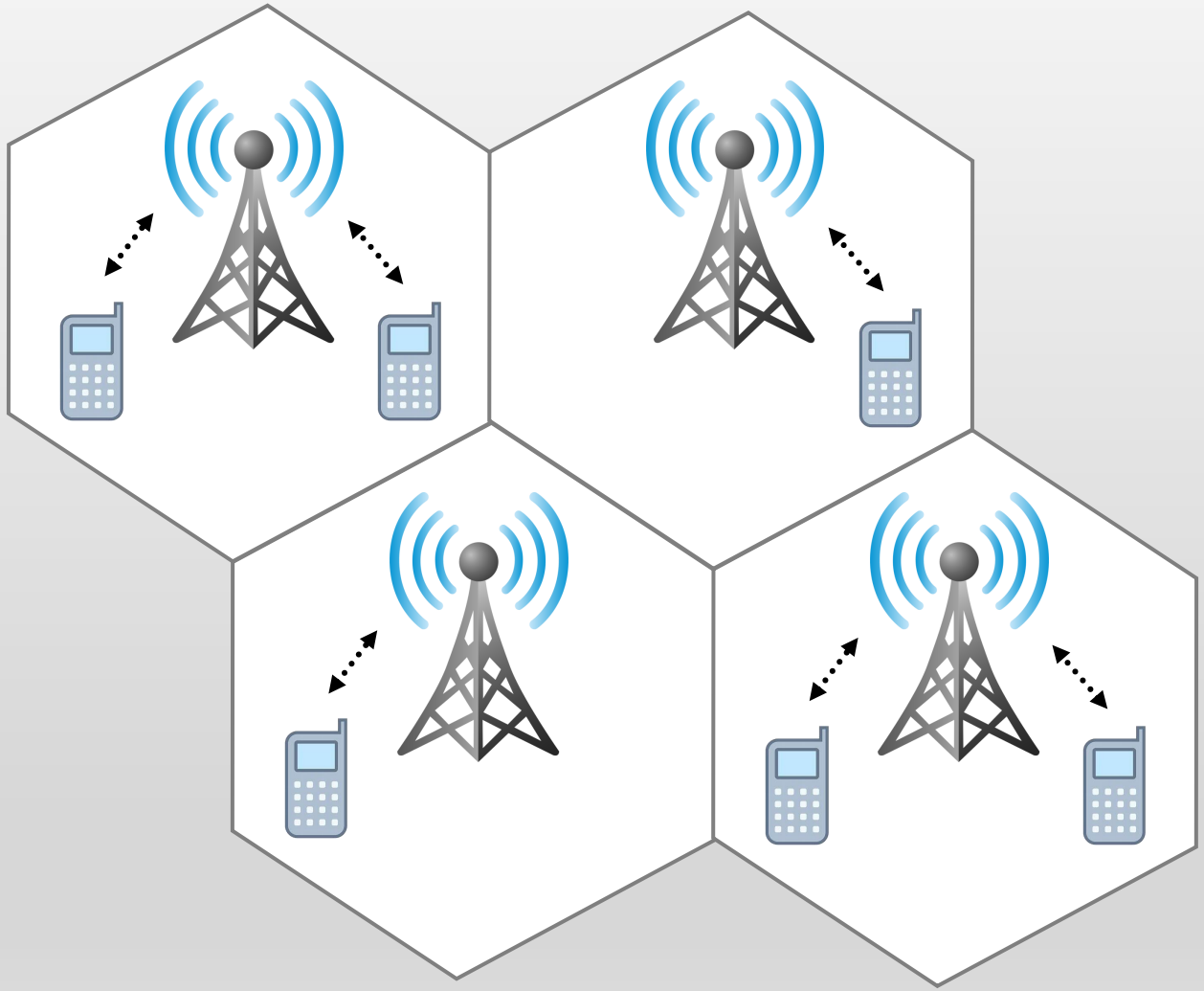
- Dr. Barkan conceived of invention in 1999
- Studying computer network architectures at the Technion University
- Cellular data very expensive, but university had strong Internet connection



Conventional Cellular Base Stations

Distributed to implement the cells of a cellular network

- High transmit power
- Expensive
- Limit on number of simultaneous users



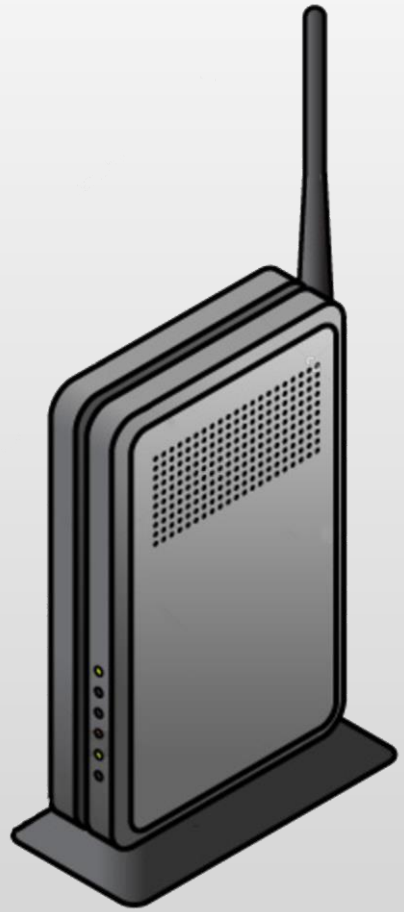
Conventional Base Station

The Invention

- Dr. Barkan realized Internet connection could transmit phone data instead of cellular base stations.

- Conceived of “add-on base station” device that miniaturizes a cell tower to fit in a home or small business.

- “Add-on base station” transmits and receives cell phone data through a connection to a **packet based data network** (e.g., the Internet), **not** a cell tower.



Add-On Base Station

The Invention - Benefits

- Cheap to deploy
- Can be installed by consumers
- Reduces/eliminates need for expensive cell towers
- Improves cellular signal
- Cellular providers can “offload” bandwidth from towers to consumer Internet

(12) **United States Patent**
Barkan

(10) **Patent No.: US 8,014,284 B2**
(45) **Date of Patent: Sep. 6, 2011**

(54) **CELLULAR NETWORK SYSTEM AND METHOD**

(76) Inventor: **Elad Barkan**, Kefar Sirkin (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1478 days.

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(12) **United States Patent**
Barkan

(10) **Patent No.: US 8,559,312 B2**
(45) **Date of Patent: *Oct. 15, 2013**

(54) **SYSTEMS, DEVICES AND METHODS FOR PROVIDING ACCESS TO A DISTRIBUTED NETWORK**

(76) Inventor: **Elad Barkan**, Kfar Sirkin (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 191 days.

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(12) **United States Patent**
Barkan

(10) **Patent No.: US 9,392,638 B2**
(45) **Date of Patent: Jul. 12, 2016**

(54) **SYSTEMS, DEVICES AND METHODS FOR PROVIDING ACCESS TO A DISTRIBUTED NETWORK**

(75) Inventor: **Elad Barkan**, Kfar-Sirkin (IL)

(73) Assignee: **Barkan Wireless IP Holdings, L.P.**, Wilmington, DE (US)

(56) **References Cited**

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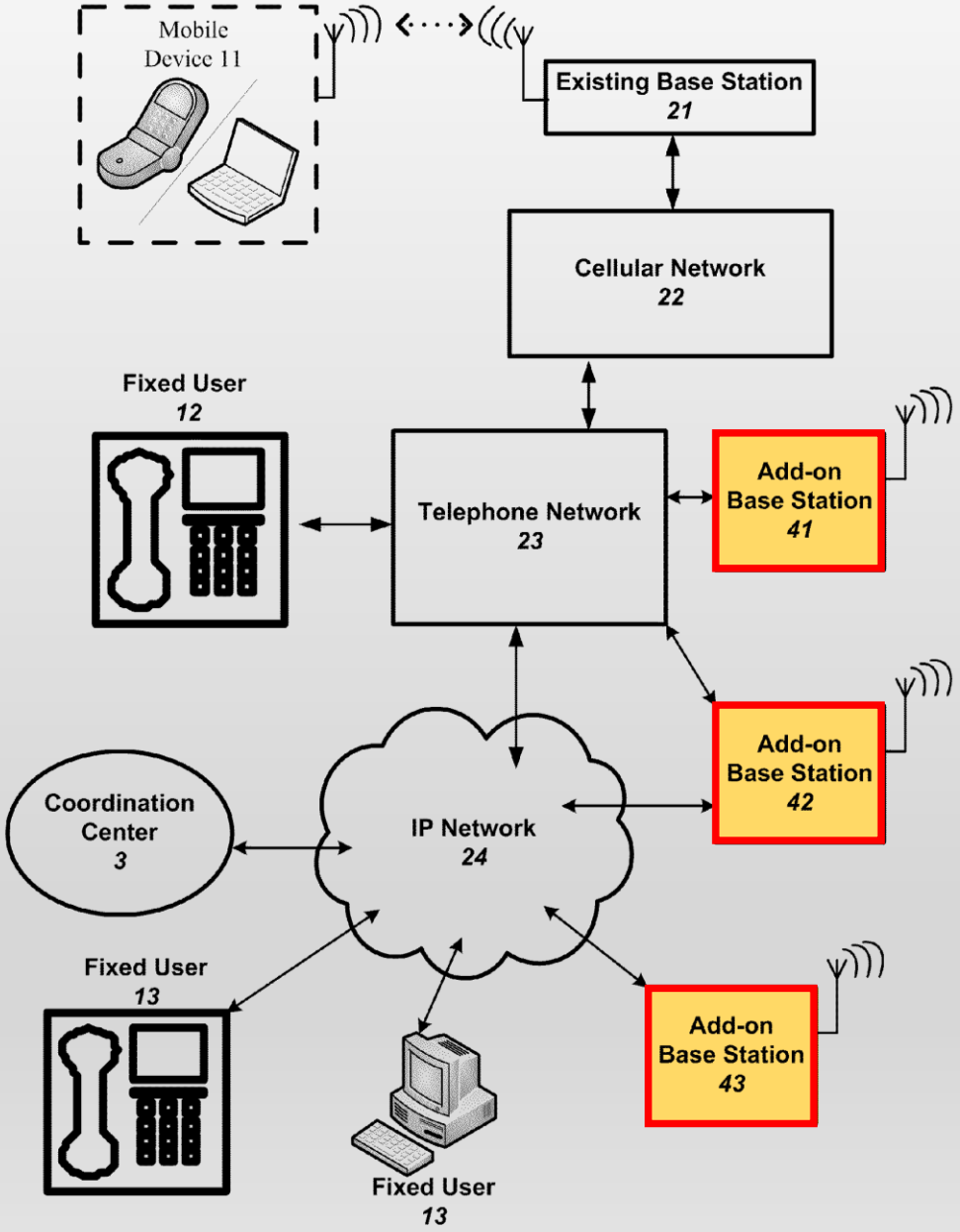
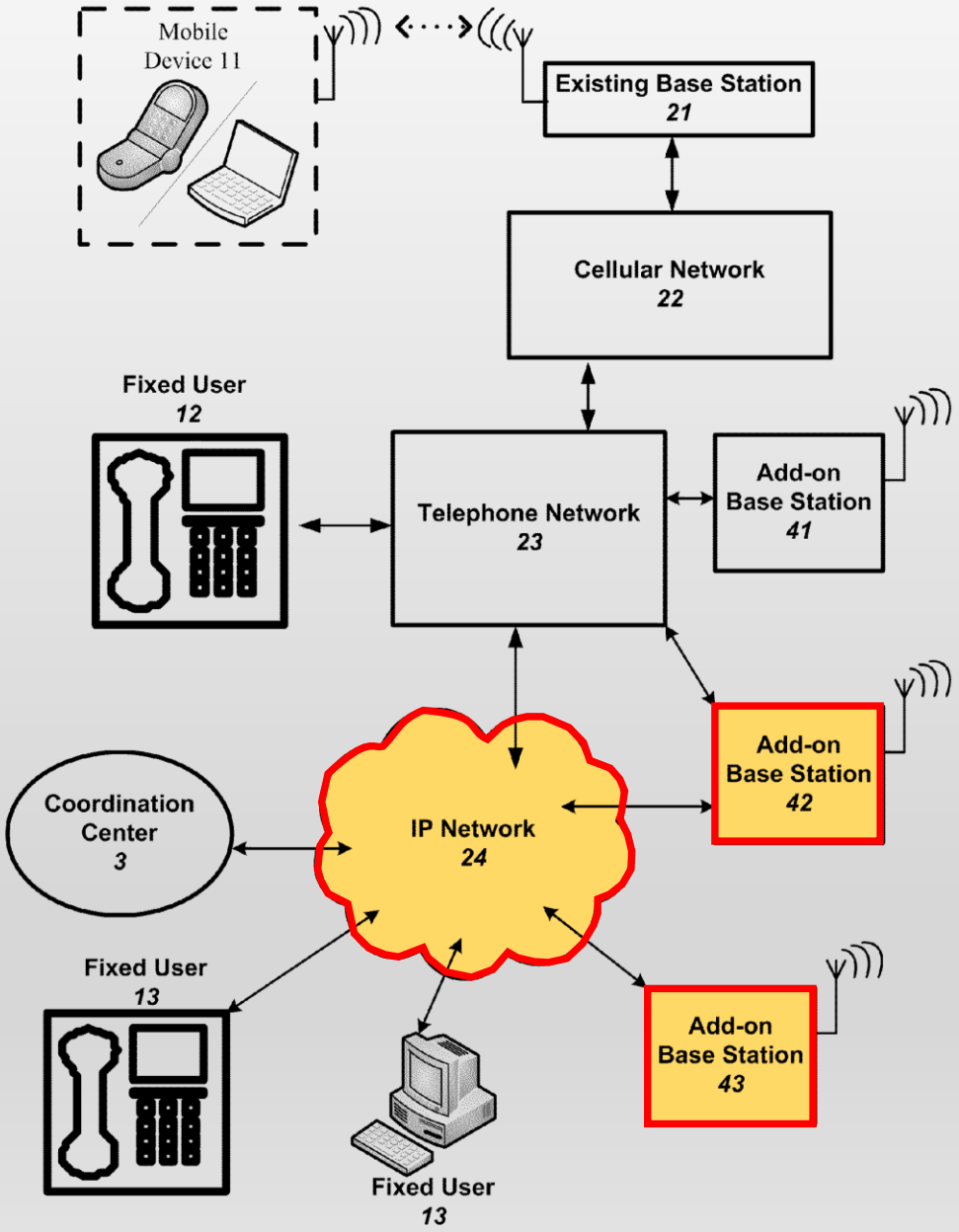
(30) **Foreign Application Priority Data**

Aug. 12, 1999 (WO) PCT/IL99/00438

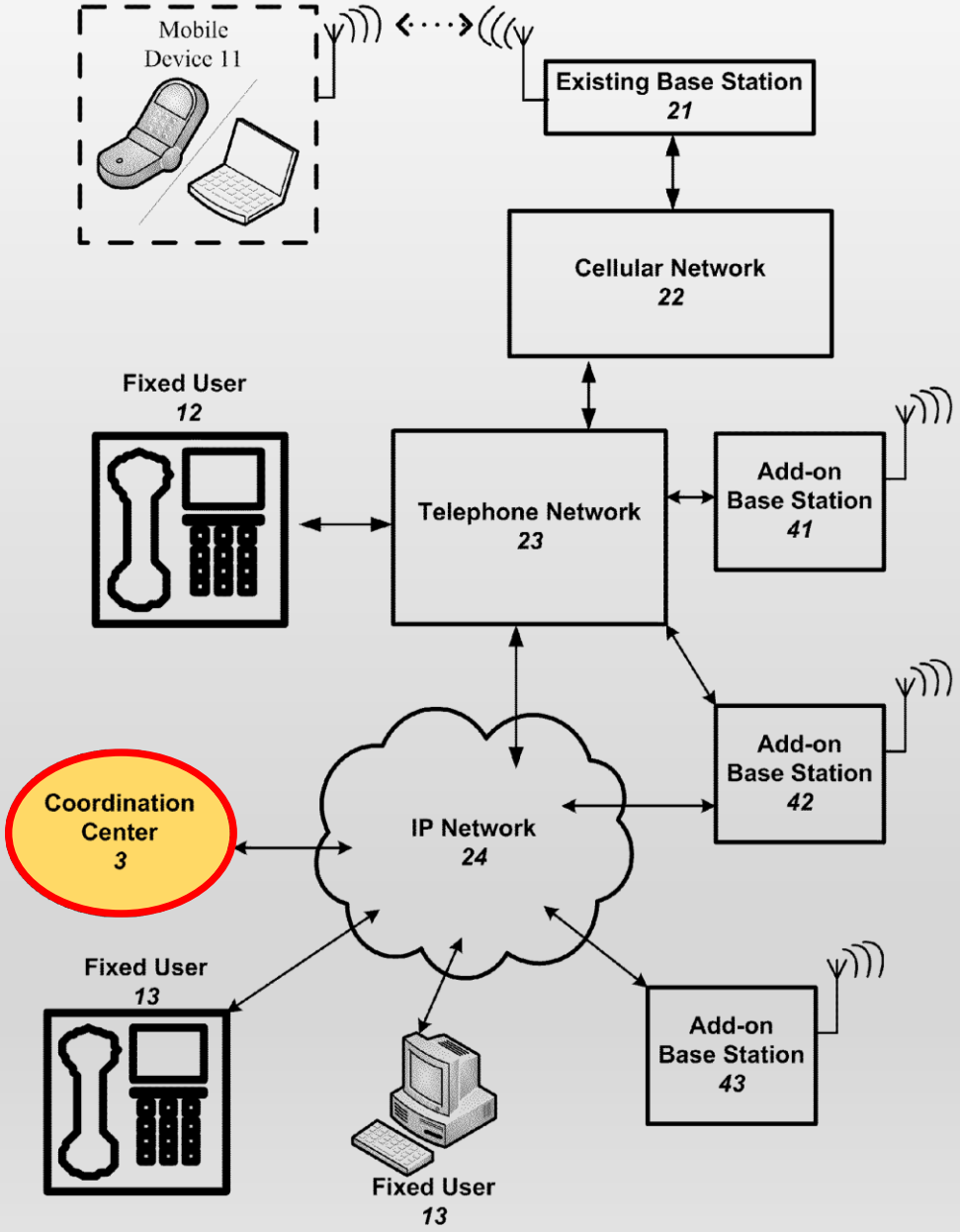
U.S. Patent No. 8,559,312 Fig. 1



U.S. Patent No. 8,559,312 Fig. 1



U.S. Patent No. 8,559,312 Fig. 1



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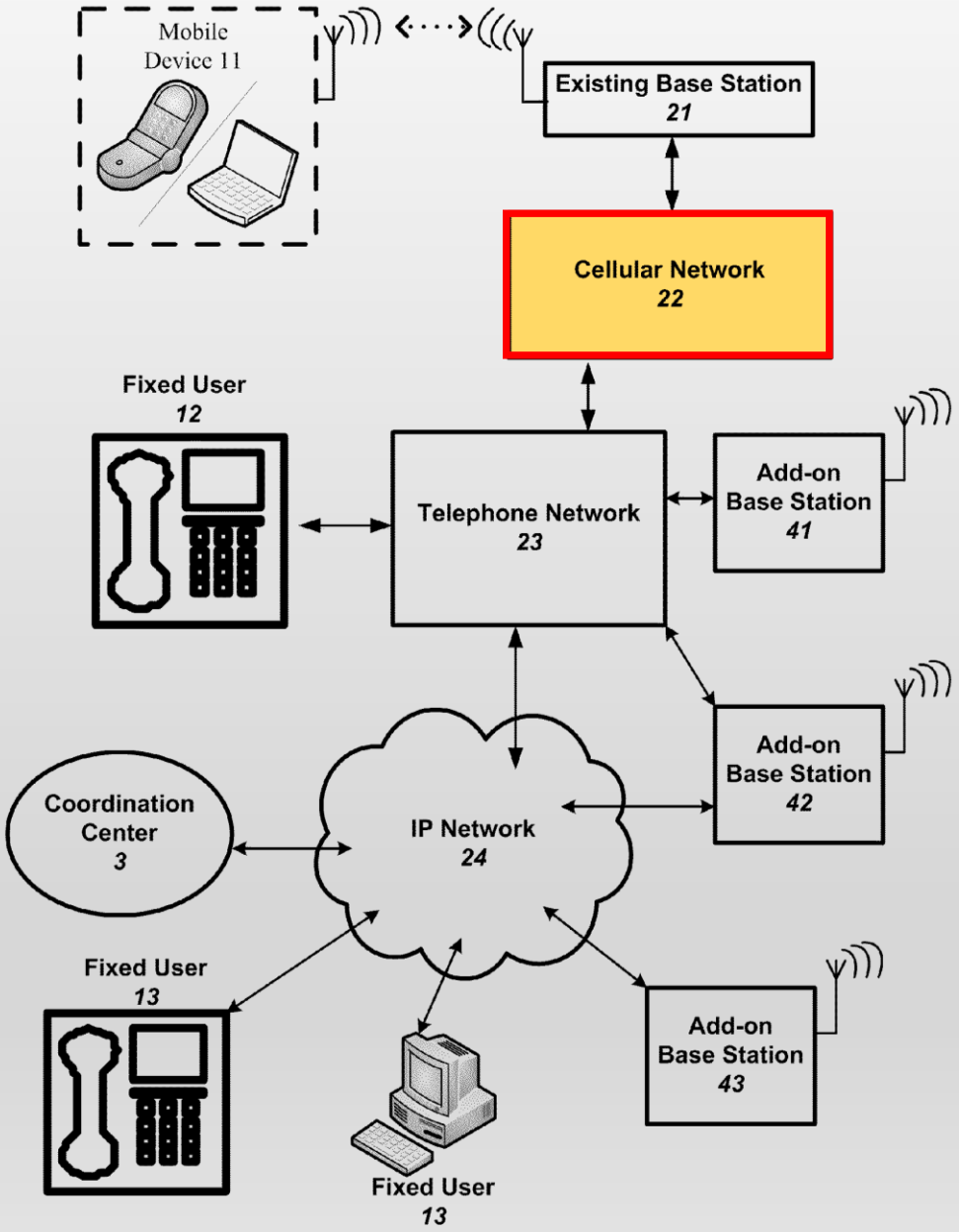
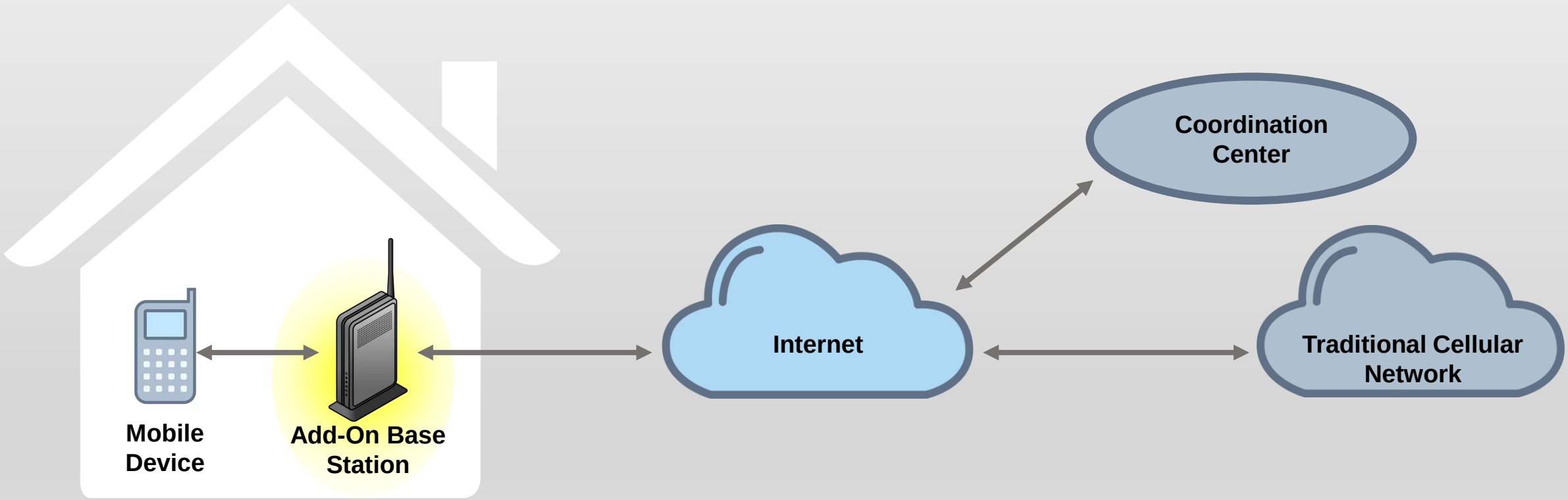
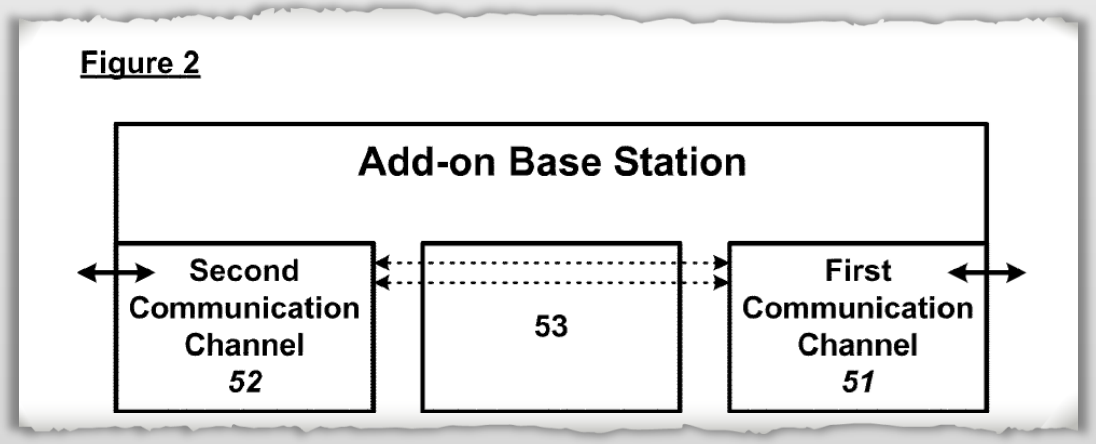


Add-On Base Station



What is an add-on base station?

Uses existing network infrastructure (*e.g.*, broadband ethernet, telephone, or DSL connection) to connect the base station and mobile user via a packet-based data network (*e.g.*, the Internet).



'312 Patent Fig. 2

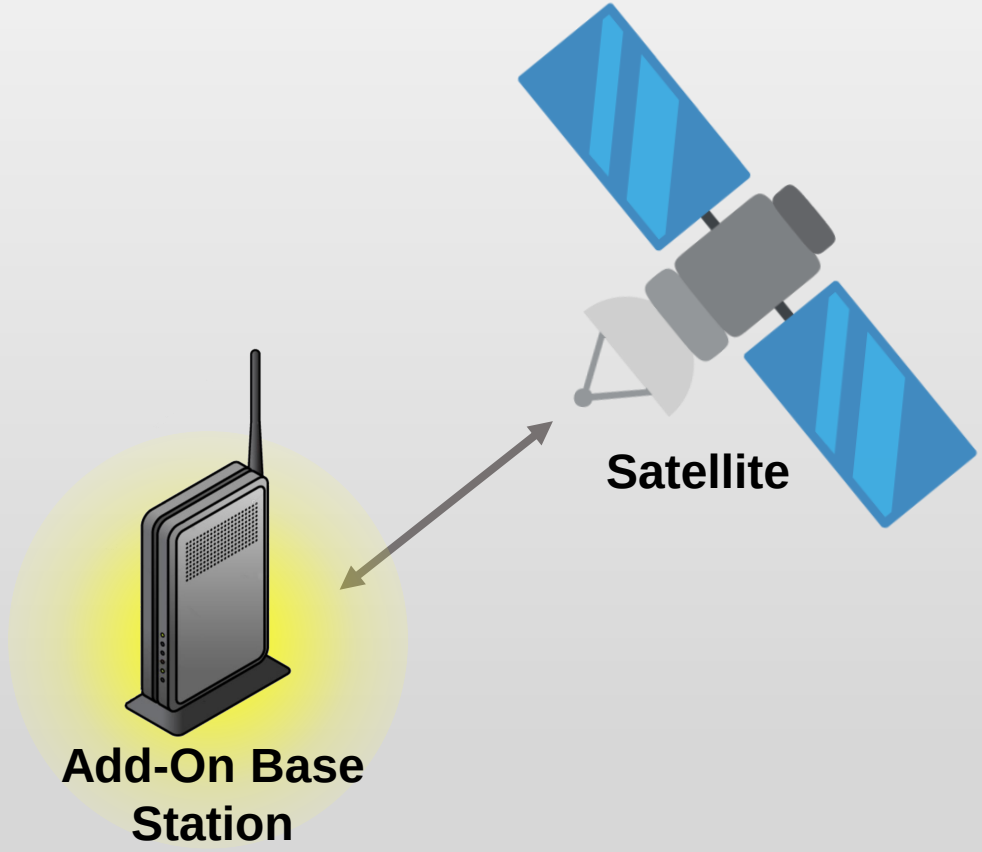
nels having the capability to serve several users at once. For example, channel **51** may be a wireless channel capable of communicating with several users using TDMA or FDMA or CDMA. Channel **52** may be an Internet connection capable of connecting to several destinations simultaneously.

'312 Patent 11:37-:41

Add-on base station?

Can (but is not required to) contain other features like:

- Tamper-free operation
- Conducting encrypted communications
- Reporting its location (*e.g.*, GPS)
- Transmitting updates regarding device status



Tamper-free units

Among the types of “tamper-free” units or hardware that can be implemented in the base stations are (a) digital documents encrypted to prevent tampering; or (b) “black box” functionality.

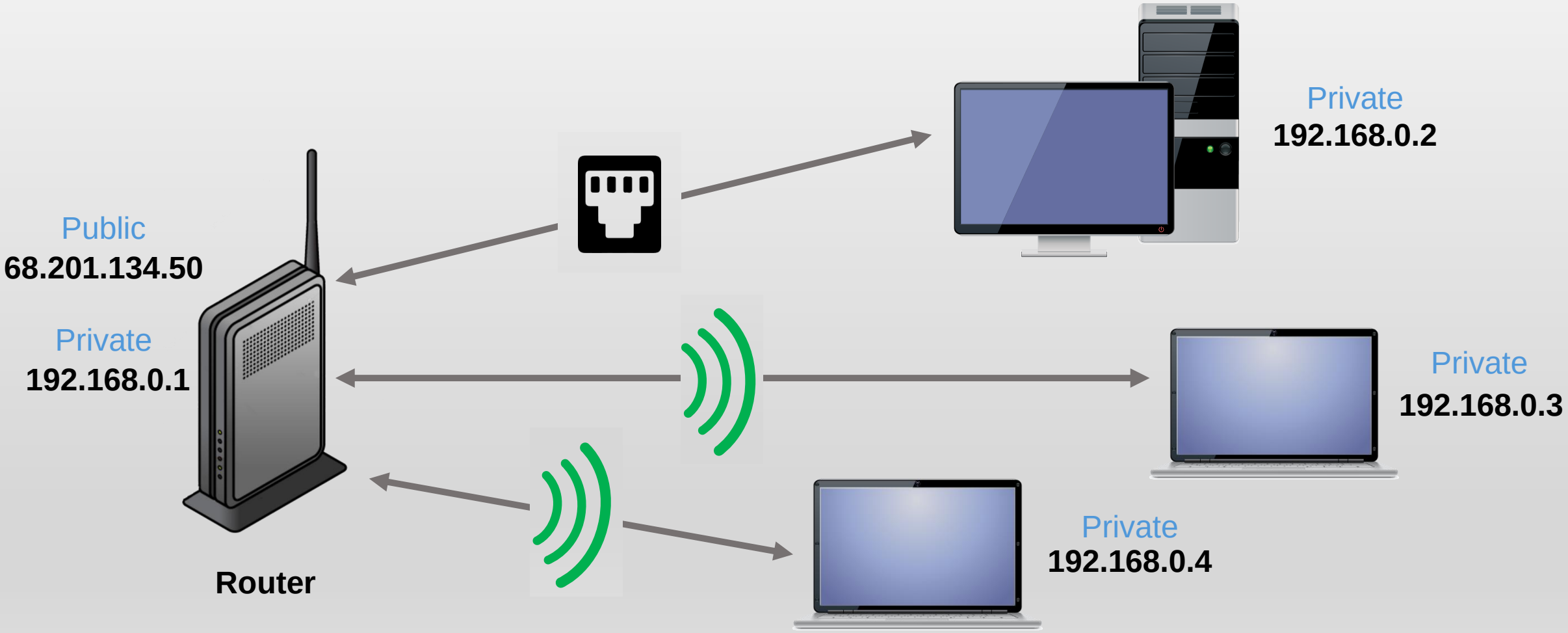
determined by an operator there. The information regarding prices of use of the net and the additional, private base stations, is disseminated as digital documents encrypted so as to prevent tampering with.

The billing unit can be a “black box” inside each apparatus. This black box can be tamper-free, including means to destroy its contents or delete the information therein, if someone tries to tamper with it. This ensures that it can be trusted to work under commands given in policy documents.

What is a “Packet-Based Data Network”?

- IP-based network, which transfers and receives digital “packets”
- For example, the Internet
- Internet is a network of many sub-networks
- Connects many “LANs” (*e.g.*, home networks), which use “frames,” not packets.

Internet-Connected Devices Often Use Private IP Addresses



What is a coordination center?

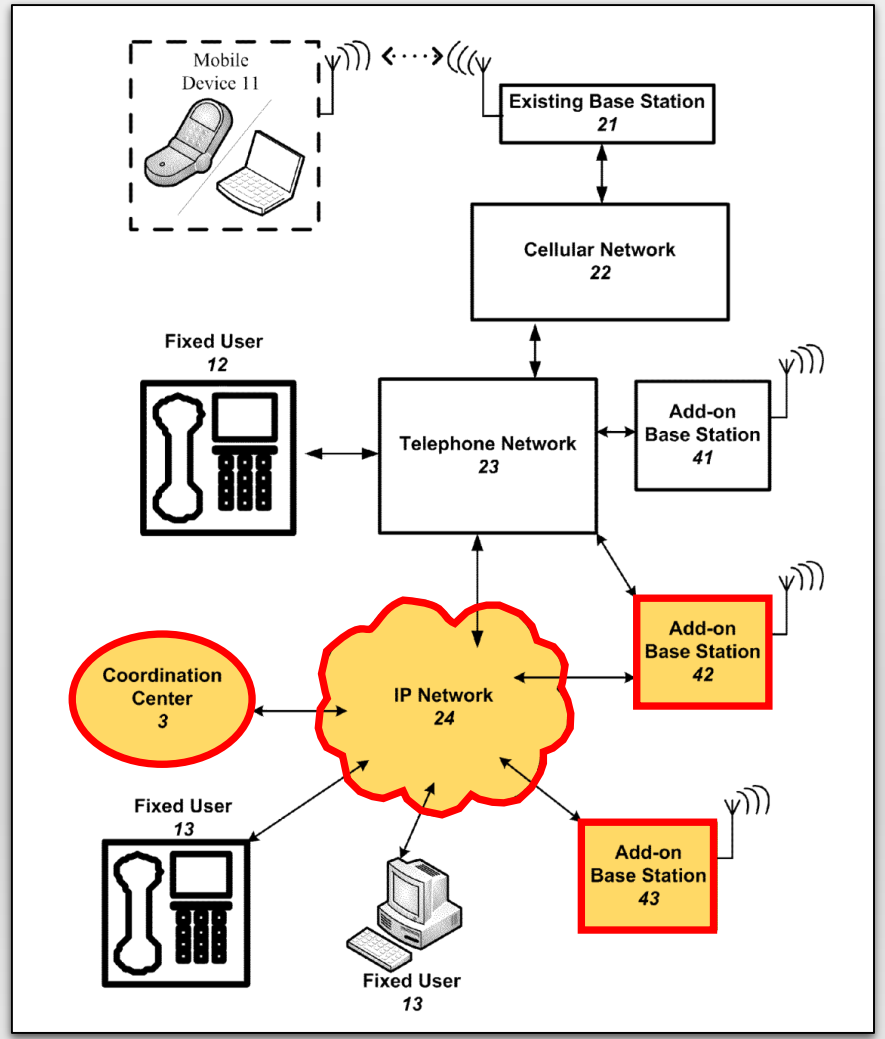
1. Provides information required for making a call

Rather, the new center just provides the information required for making a call. Thus the workload on the center is greatly reduced. Smaller, simpler and lower cost switch-boards may be used.

'284 Patent at 3:13-:16

What is a coordination center?

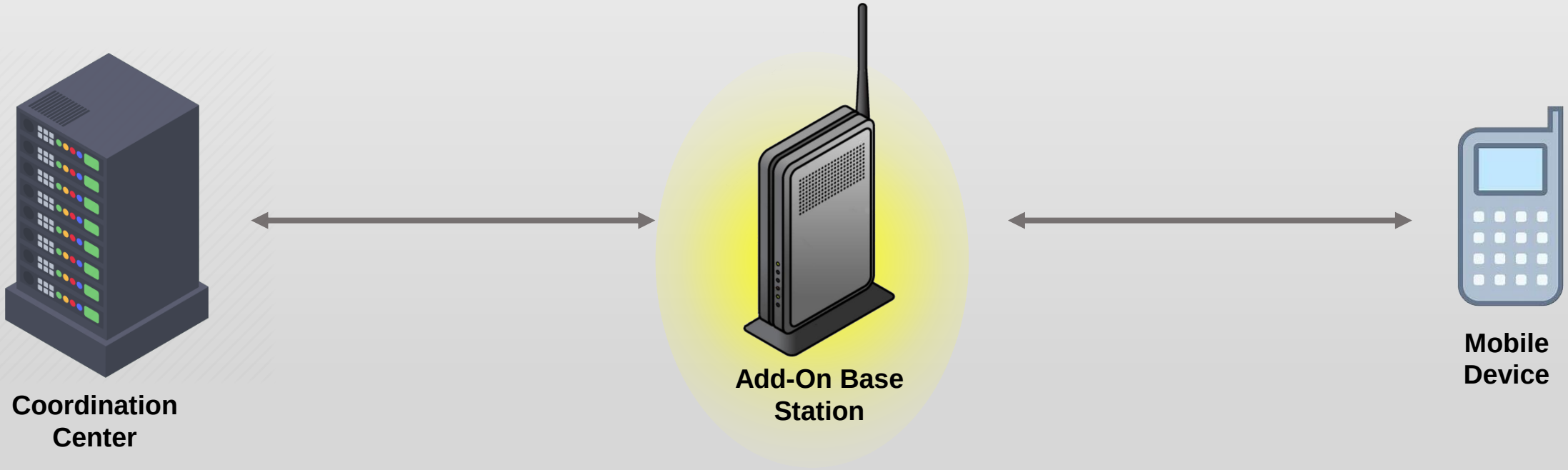
1. Provides information required for making a call



'312 Patent Fig. 1

What is a coordination center?

1. Provides information required for making a call

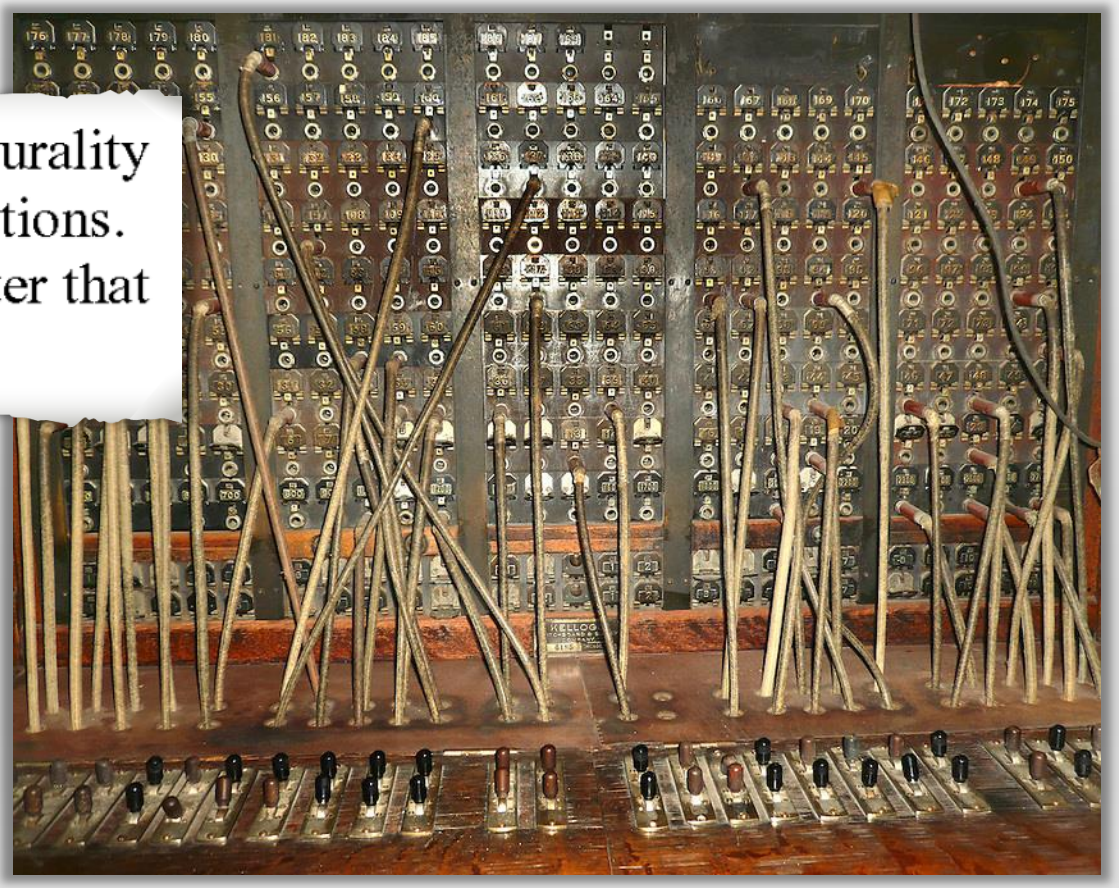


What is a coordination center?

2. Does *not* perform the actual call switching, as a switch in a traditional cellular network would

> Heretofore, a large distributed network required a plurality of large switchboards to make all the required connections.
>
> A novel approach uses a cellular coordination center that does not perform the actual call switching.

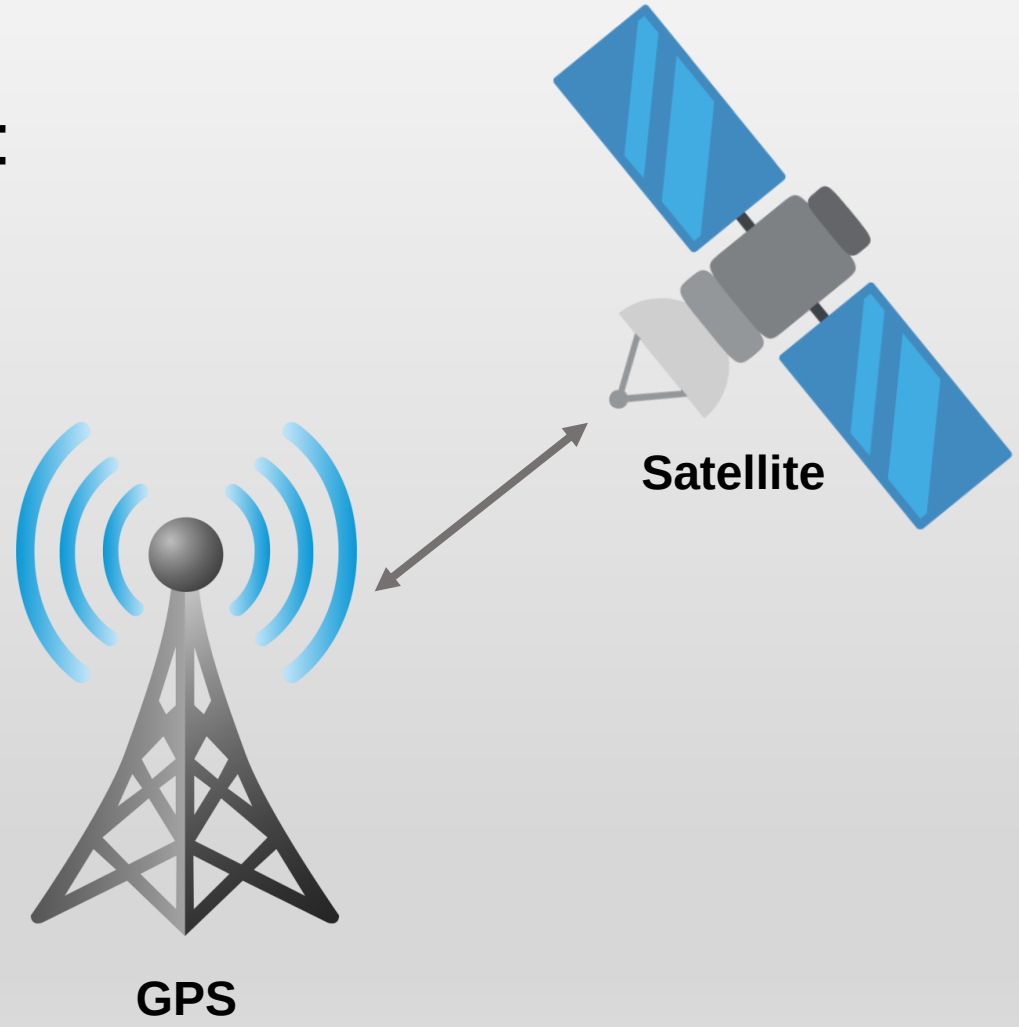
'284 Patent at 1:51-:52



What is a coordination center?

3. May (but need not) contain features like:

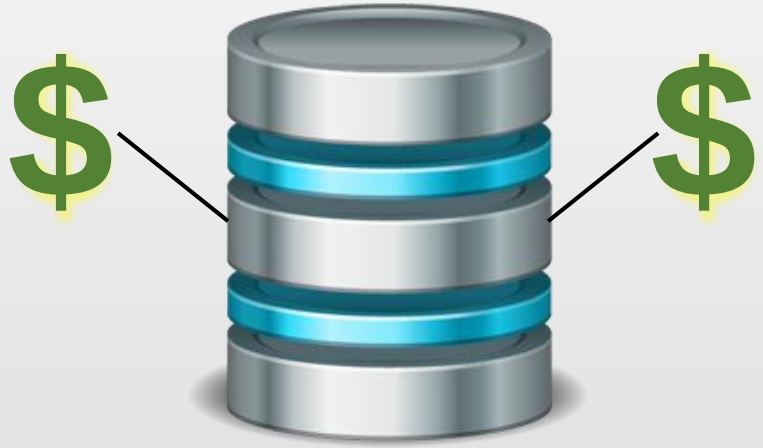
- GPS tracking of the base station.
- Receiving “updates” from the base station about its current status or operation.
- Authorizing or de-authorizing the base station from the cellular network, depending on whether the station is authorized.
- Handling data encryption.

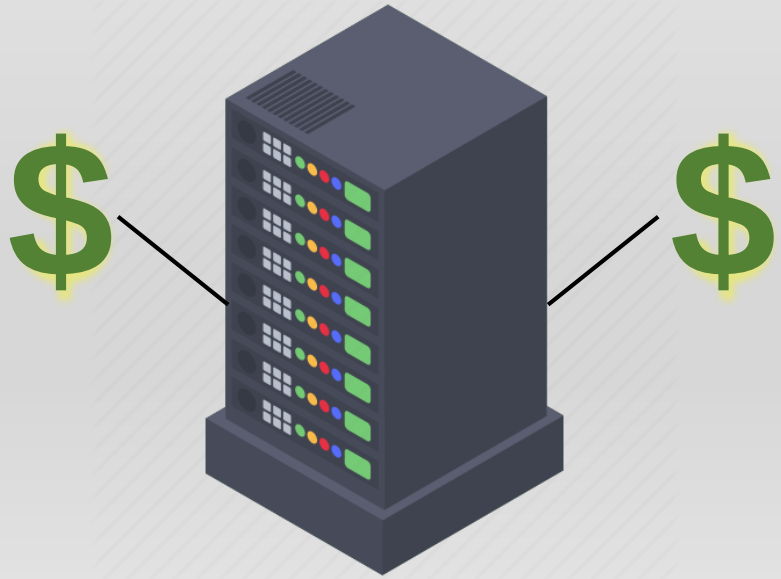


What is a consideration-related policy database (CRPD)?

- Database that stores “pricing” and “billing” information relating to use of the add-on base station

- “Pricing” or “billing” *could* also (but need not be) handled by the same server as the coordination center server.





Where is the CRPD's pricing information sent?

- In embodiments of the invention where the policy database or coordination center does store "pricing" or "billing" information, such information can be:

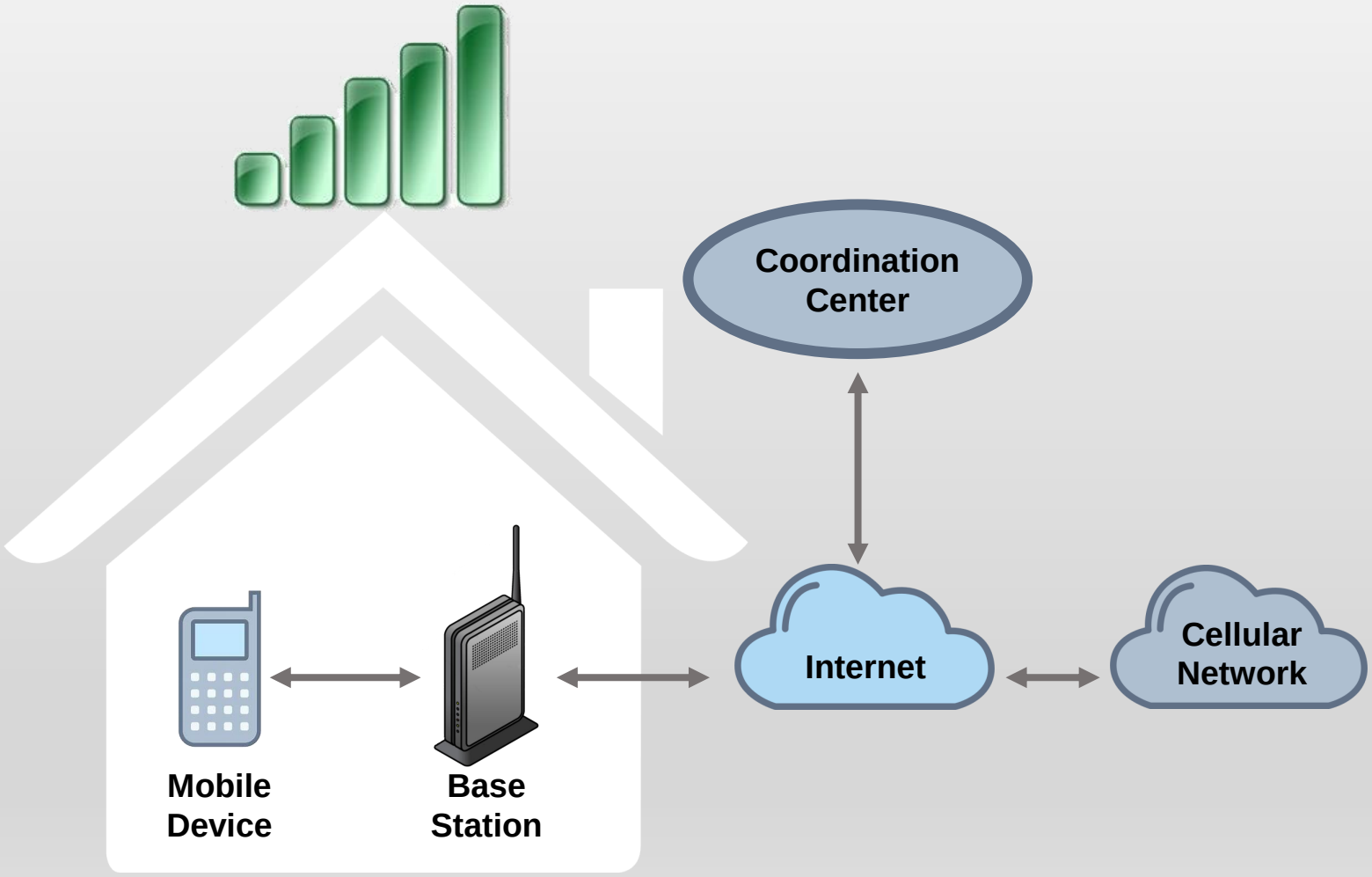
(a) transferred over an Internet

or

(b) made available to the base stations themselves.

It determines and publishes the cost for each operation over the network. The updated information may be transferred over an Internet, or may be available to add-on base stations. The information may be dispersed between units in the network. In each transaction, the parties thereto will check the

Add-On Base Station



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